

## CHAPTER 9

## Input Devices

**INDUSTRY EARLY REVIEW DRAFT V.0.3 — 07/20/1999 7:19 PM—**

**NOTE to REVIEWERS:** This is a very early draft version, and no effort has been made to reconcile changes in cross references to other chapters in the guide. Please look for comments such as this in the draft, which encourage your feedback on specific issues.

**Please submit comments using the form on <http://www.pcdesguide.org> or by sending e-mail to [comments@pcdesguide.org](mailto:comments@pcdesguide.org).**

**IMPORTANT:** The requirements defined in this guide provide guidelines for designing PC systems that will result in an optimal user experience with typical Windows-based applications running under either the Microsoft Windows98 “Millennium” or later or Windows2000 Professional or later operating systems. These design guidelines are not the basic system requirements for running any version of Windows operating systems.

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This chapter presents requirements ~~and recommendations for I/O ports and for input~~ devices, including ~~serial and parallel~~ legacy ports, wireless capabilities, and input devices and connectors.

~~System designers are encouraged to consider solutions such as USB rather than traditional connections for external devices.~~ USB support is required for PC 2001 systems, and easy connectivity is important in situations where devices might be interchanged on a regular basis. USB ~~is expected to replace~~ legacy serial and parallel ports as the dominant external ~~connector in the connector near future.~~

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## General Input Device Requirements

This section summarizes requirements for ~~serial and parallel~~ legacy ports.

**[NEW] All non-integrated input devices meet USB HID specifications**

**Note to Reviewers: This new requirement is similar to PC 99 [5.3].**

All keyboards, pointing devices, game pads, and their connections included with a PC 2001 system must comply with the *USB Device Class Definition for Human Interface Devices, Version 1.1* or later, and *USB HID Usages Table, Version 1.1* or later. This is required whether the devices are implemented as wired or wireless.

For implementation guidelines under the Windows family of operating systems, see the Windows 2000 DDK. See also the web site available at <http://www.microsoft.com/hwdev/input/>.

**Note to Reviewers: This is a key requirement for legacy migration advances for PC 2001.**

~~[13.1] [DELETE] System includes connection for external serial devices~~

~~[13.2] [DELETE] System includes connection for external parallel devices~~

~~[13.3] [DELETE] System includes external connection for keyboard~~

~~[13.4] [DELETE] System includes pointing device connection and pointing device~~

~~[13.5] [DELETE] System includes USB game pad or joystick~~

~~[13.6] [DELETE] System includes built-in wireless capabilities~~

**[13.7] Devices use USB or external bus connections rather than legacy serial or parallel ports**

Although legacy parallel and serial ports can be provided on a PC 2001 system, no devices that use these ports ~~should~~ can be provided with a system, ~~with the exception of printers~~. A legacy serial port cannot be used as the connection for the mouse or modem.

**[13.8] [REDUNDANT] All devices meet PC 2001 general device requirements**

**Note to Reviewers: This is a general PC 2001 requirement and is not repeated for every device class**

**[13.9] Serial port meets device class specifications for its bus**

**Note to Reviewers: In future versions of this design guide, this section will address mappers for USB and legacy ports.**

**Please comment about how you believe the design guide should address mappers.**

As required for all PC 2001 devices, a serial port implementation that uses a non-legacy bus must meet the specific device class requirements for that bus. For example, a USB serial port implementation must comply with all related USB specifications, including:

?? *Universal Serial Bus Specification, Version ~~1.0~~1.1* or later (also known as the USB core specification)

?? *Universal Serial Bus Device Class Definition for Communication Devices, Version 1.0* or later

The “Standard Serial Interface Circuit Emulation” appendix in the *USB Device Class Definition for Communication Devices* specifically addresses serial-port compatibility.

**[13.10] If implemented, legacy serial port is implemented as 16550A UART or equivalent and supports 115.2K baud**

Legacy ports are ~~not recommended~~discouraged for PC 2001 systems, but if implemented, such ports must meet the requirements defined in *Legacy Plug and Play Guidelines*, available online at <http://www.pcdesguide.org/library.htm>.

**[13.11] If implemented, legacy serial port supports dynamic resource configuration**

For implementation guidelines, see *Legacy Plug and Play Guidelines*, available online at <http://www.pcdesguide.org/library.htm>.

**[13.12] If implemented, conflict resolution for legacy serial port ensures availability of at least one serial port**

For implementation guidelines, see *Legacy Plug and Play Guidelines*, available online at <http://www.pcdesguide.org/library.htm>.

**[13.13] Parallel port meets device class specifications for its bus**

**Note to Reviewers: In future versions of this design guide, this section will address mappers for USB and legacy ports.**

**Please comment about how you believe the design guide should address mappers.**

As required for all PC 2001 devices, a parallel port implementation that uses a non-legacy bus must meet the specific device class requirements for that bus.

For example, a parallel port implementation that uses USB must comply with all related USB specifications, including the USB core specification and any specific device class specification.

[13.14] **If a legacy parallel port is implemented**, flexible resource configuration is supported for each parallel port

For implementation guidelines, see *Legacy Plug and Play Guidelines*, [available online at http://www.pcdesguide.org/library.htm](http://www.pcdesguide.org/library.htm).

[13.15] **If a legacy parallel port is implemented**, EPP support does not use restricted I/O addresses

For implementation guidelines, see *Legacy Plug and Play Guidelines*, [available online at http://www.pcdesguide.org/library.htm](http://www.pcdesguide.org/library.htm).

[13.16] **If a legacy parallel port is implemented**, compatibility, nibble mode, and ECP protocols meet IEEE 1284-1994 specifications

For implementation guidelines, see *Legacy Plug and Play Guidelines*, [available online at http://www.pcdesguide.org/library.htm](http://www.pcdesguide.org/library.htm).

[13.17] **If a legacy parallel port is implemented**, port connectors meet IEEE 1284-I specifications, minimum

For implementation guidelines, see *Legacy Plug and Play Guidelines*, [available online at http://www.pcdesguide.org/library.htm](http://www.pcdesguide.org/library.htm).

[13.18] **If a legacy parallel port is implemented**, IEEE 1284 peripherals have Plug and Play device IDs

For implementation guidelines, see *Legacy Plug and Play Guidelines*, [available online at http://www.pcdesguide.org/library.htm](http://www.pcdesguide.org/library.htm).

**[13.19] [DELETE] Device identification string provides a Compatible ID key**

**Note to Reviewers: Recommendations are not included in PC 2001.**

[13.20] **If implemented**, daisy-chained parallel port device is Plug and Play capable

Daisy-chained parallel port devices must be Plug and Play capable. The daisy-chained parallel port device must be capable of answering Plug and Play requests from the host.

All pass-through devices must comply with IEEE 1284.3 because of end-of-chain issues with IEEE 1284 and ~~IEEE 1284.3, it is also required that all pass-through devices comply with~~ IEEE 1284.3.

[13.21] **Pointing-device connection meets requirements for its bus class**

If a USB port is used, the following requirements must be met:

?? Meet requirements in *USB Specification, Version 1.0-1* or later

?? Meet requirements in *USB Human Interface Device Class Specifications, Version 1.0-1* or later

?? Implement minidriver support based on WDM Human Interface Device (HID) class support in the operating system, as defined in the Windows 2000 DDK

For information about implementing minidriver support based on WDM Human Interface Device (HID) class support in the operating system, see “Chapter 1 I/O Requests for HID Minidrivers” in the Windows 2000 DDK, which defines the implementation for both Windows 98 and Windows 2000 (online at [http://www.microsoft.com/ddk/ddkdocs/Win2k/hidireq\\_92k2.htm](http://www.microsoft.com/ddk/ddkdocs/Win2k/hidireq_92k2.htm)).

For implementation guidelines for legacy devices, see *Legacy Plug and Play Guidelines*, [available online at http://www.pcdesguide.org/library.htm](http://www.pcdesguide.org/library.htm).

### **~~13.22. [DELETE] Remote control pointing device provides PC 2001 minimum support~~**

**Note to Reviewers: Recommendations are not included in PC 2001.**

### **[13.23] Keyboard connection meets requirements for its bus class**

If a USB connection is used, it must meet the following requirements:

- ?? *USB Specification, Version 1.0-1* or later
- ?? *USB Human Interface Device Class Specifications, Version 1.0-1* or later
- ?? Minidriver support based on WDM HID class support in the operating system

If a USB keyboard is the sole keyboard implementation in an Intel Architecture system, it must support the USB Boot Device specification. The system BIOS must provide boot support as specified in requirement [3.5], “BIOS meets PC 2001 requirements for boot support,” and as defined in *Universal Serial Bus PC Legacy Compatibility Specification, Version 0.9* or later.

For implementation guidelines for legacy devices, see *Legacy Plug and Play Guidelines*, [available online at http://www.pcdesguide.org/library.htm](http://www.pcdesguide.org/library.htm).

### **[13.24] No interference occurs between multiple keyboards**

*Mobile PC Note*

If the system includes more than one keyboard, there must be no conflicts. For example, when a mobile PC is connected to a docking station, more than one keyboard can be attached to the system simultaneously. The keyboard ports on a mobile PC and a docking station must be able to resolve conflicts between the two ports when the mobile unit is docked. Windows supports multiple configurations through the registry and will determine which keyboard to enable.

For more information about managing resources and devices for a mobile PC/docking station pair, see Chapter [X], “Mobile PC 2001.”

**[13.25] If implemented, Windows and Application logo keys meet Microsoft guidelines**

The following are requirements for a keyboard design that includes any Windows logo keys:

?? The keyboard must be developed according to technical requirements in *New Key Support for Microsoft Windows Operating Systems and Applications*.

The keyboard scan codes for Windows operating systems are available at <http://www.microsoft.com/hwdev/desinit/scancode.htm>.

?? The keyboard must be compatible at the Windows virtual key-code level.

?? The keyboard must pass the requirements in the Windows logo key testing software.

?? The Windows logo key must function as a modifier (CTRL, SHIFT, or ALT).

?? The Windows Flag trademark must be clearly distinguished on the key top according to the guidelines provided in *New Key Support for Microsoft Windows Operating Systems and Applications*.

*Mobile PC Note*

~~Given the crowded nature of compact keyboards on mobile PCs and keyboards that support double-byte characters, such as Japanese language keyboards, it might be difficult to add three new keys.~~ For mobile PCs, minimal implementation of new keys includes the addition of one Windows logo key and one Application key.

**13.26. [REDUNDANT] Game-control device meets USB HID class specification requirements**

**Note to Reviewers: Legacy and proprietary game-pad solutions are not acceptable for PC 2001. Game pads, joysticks, and other input devices must be implemented as USB devices.**

## Wireless Component Requirements

**Note to Reviewers: This section is still being reviewed for modern RF implementations. Your input is requested. Compare similar guidelines in the Communications chapter under “Home Networking Guidelines.”**

This section defines requirements for wireless components, provided either as infrared (IR) and radio frequency (RF) devices, based on communication standards developed by the Infrared Data Association (IrDA).

For information about requirements for wireless networking devices, see “IrDA Requirements for Network Communications” in Chapter [X], ~~“Network Communication~~ Devices.”

The requirements listed in this section must be met if wireless capabilities are provided in the system. The general device requirements are defined in “System Requirements for I/O Ports and Devices” earlier in this chapter.

Manufacturers who are implementing designs that include IrDA Control devices, also known as IrBus, are strongly encouraged to join IrDA and to obtain the IrDA-approved version of the IrDA Control specification, plus information on the availability of parts and driver software.

#### [13.27] IR device uses NDIS 5.0 miniport driver

This requirement applies for IrDA Data devices. An NDIS 5.0, IrDA miniport driver is required for all IrDA Data devices. For documentation and sample source code for building a miniport driver, see ~~the Windows 2000 DDK.~~

~~For documentation and sample source code for building a miniport driver,~~ “Chapter 10 IrDA Miniport NIC Drivers” in the Windows 2000 DDK (online at [http://www.microsoft.com/ddk/ddkdocs/Win2k/210irda\\_8fdz.htm](http://www.microsoft.com/ddk/ddkdocs/Win2k/210irda_8fdz.htm)).

#### [13.28] IR device meets IrDA specifications

~~Developers are encouraged to~~ Recommended: Support specifications for both IrDA Data and IrDA Control devices.

An IR device must be designed to comply with approved IrDA specifications.

If the system is intended to run data transfer applications with other IrDA Data devices, it must be in compliance with the IrDA Data specification.

If an IrDA Control application is used in a PC 2001 system, it must be in compliance with the IrDA Control specification, which was approved by IrDA in early 1998. The first IrDA Control-compliant devices are expected to ship in late 1998.

If a system is intended for the consumer market, it should have support for both IrDA Control and IrDA Data ~~is recommended~~ to meet the consumer’s expectations for IR device interoperability. The emergence of still-image cameras with IrDA Data capability increases the importance of IrDA Data support in consumer systems.

**[13.29] [REDUNDANT] IR device meets PC 2001 bus and port specifications****Note to Reviewers: This is a basic PC 2001 requirement.****[13.30.] [REDUNDANT] IR device supports dynamic resource configuration****Note to Reviewers: This is a basic PC 2001 requirement.****[13.31.] [REDUNDANT] IR device meets USB guidelines for interfacing with IrDA Data and IrDA Control devices****[13.32] System supports standard input speeds of 4 Mb/s**

Device support is required for Fast IR (FIR) input speeds of 4 Mb/s for all IrDA Data devices.

**[13.33] System provides a separate, physically-isolated transceiver for each IR protocol supported**

This requirement ensures correct implementation for a system that includes IR support for any combination of devices that use the IrDA Data protocol, the IrDA Control protocol, or the universal consumer-IR approach to legacy remote control, each of which use different device signals. ~~A system that uses only a specific IR device protocol will restrict the ability to use multiple input devices and might also restrict other capabilities.~~

~~A PC 2001 system that advertises itself as supporting all three IR solutions — IrDA Data protocol, IrDA Control protocol, and legacy remote control IR — must provide a separate transceiver for each solution.~~ The system must also expose each separate transceiver to the operating system.

~~The transceivers must be physically isolated from each other; an example is placing each transceiver on a different edge of the system case. Although some IrDA member companies have tested IrDA Data, IrDA Control, and legacy remote control IR transceivers without spatial separation and demonstrated adequate performance, interference-free operation cannot be assured without physical isolation.~~

If multiple IR protocols are supported, controllers must provide separate data connections into the PC using USB. The IrDA and USB industry associations define guidelines for how to build and interface such devices. Contact information can be found in “References for ~~I/O Ports and Input~~ Devices” later in this chapter.



**~~13.34. [DELETE] System supports RF capabilities~~****Note to Reviewers: Recommendations are not included in PC 2001****~~13.35. [DELETE] RF implementation uses a low-power RF alternative~~****Note to Reviewers: Recommendations are not included in PC 2001****~~13.36. [DELETE] RF implementation provides a method to defeat noise and conflict with other RF devices~~****Note to Reviewers: Recommendations are not included in PC 2001****~~13.37. [DELETE] System and RF device have separate local certification~~****Note to Reviewers: Recommendations are not included in PC 2001**

## Smart Card Requirements

This section defines requirements for smart card devices. Such devices are not required, but if implemented, must comply with the requirements defined in this section. The general device requirements are defined in “[General Input Device System Requirements for I/O Ports and Devices](#)” earlier in this chapter.

**Note to Reviewers: We are interested in your comments on the industry direction for Smart Cards.**

**[13.38] Smart card reader complies with ISO 7816**

A smart card reader must comply with the following ISO specifications:

- ?? ISO 7816-1:1987 Identification cards—Integrated circuit(s) cards with contacts—Part 1: Physical characteristics
- ?? ISO 7816-2:1988 Identification cards—Integrated circuit(s) cards with contacts—Part 2: Dimensions and location of the contacts
- ?? ISO/IEC 7816-3:1997 Information technology—Identification cards—Integrated circuit(s) cards with contacts—Part 3: Electronic signals and transmission protocols

**[13.39] Smart card reader supports ISO 7816 T=0 and T=1 protocols**

A smart card reader must support the asynchronous protocols T=0 and T=1 as described in ISO 7816-3, either in hardware or in the driver for the operating system. Both protocols must be supported fully. The smart card reader and the driver must support cards that can handle both protocols.

The following protocol rules apply for the T=1 protocol:

- ?? A transmission is defined as sending a command to a smart card using one or more T=1 blocks and receiving the corresponding answer using one or more T=1 blocks as defined in ISO 7816-3.

?? The very first transmission—after a reset of the smart card—should start with an Information Field Size Device (IFSD) request, as defined in ISO 7816-3, Amendment 1, Section 9.5.1.2.

If the current card does not support an IFSD request (the card should reply with an R-Block indicating “Other error”), the transmission should continue with an I-Block.

After a successful RESYNCH request, the transmission must restart from the beginning with the first block with which the transmission originally started.

Support for protocols other than T=0 and T=1 is optional.

**[13.40] Smart card reader supports inverse-convention smart cards**

A smart card reader must support inverse-convention smart cards either in hardware or in the driver for the operating system.

**[13.41] Smart card reader supports 258-byte packets in T=0 and 259-byte packets in T=1**

A smart card reader must support the exchange of the following in a single transmission:

?? 258 byte packets in T=0—that is, 256 data bytes plus the two status words SW1 and SW2

?? 259 byte packets in T=1—that is, 254 INF bytes plus NAD, PCB, LEN, and two EDC bytes

**[13.42] Smart card reader supports a smart card insertion/removal monitor**

A smart card reader must be able to detect and report smart card insertions and smart card removals without any user intervention other than removing or inserting the smart card itself. Preferably, the reader uses an interrupt mechanism to report the smart card insertion/removal to the system. A driver polling method to detect smart card insertion and removals is not recommended.

**[13.43] Smart card reader supports PTS**

To support multi-protocol smart cards and smart cards using higher data rates and higher clock frequencies, the reader must support protocol type selection (PTS) according to ISO 7816-3 (1997-12-15) Section 7.

**[13.44] Smart card reader supports 3.5795 MHz minimum clock frequency**

A smart card reader must support a minimum clock frequency of 3.5795 MHz.

**[13.45] Smart card reader supports 9600 bps minimum data rate**

A smart card reader must support a minimum data rate of 9600 bits per second.

~~Recommended: The reader supports data higher rates: 3.5795 MHz with default communications settings.~~

**[13.46] Smart card reader supports the Power Down command**

A smart card reader must support the Power Down command to turn off power of a smart card, as defined in ISO 7816-3 (1997-12-15) Section 5.4.

~~13.47. [DELETE] Smart card reader does not use an additional power supply~~

**Note to Reviewers: Recommendations are not included in PC 2001**

## Plug and Play and Bus Design for ~~I/O Ports and~~Input Devices

The items in this section are requirements for Plug and Play capabilities.

**[13.48.] [REDUNDANT] Each device has a unique Plug and Play device ID**

**Note to Reviewers: These are basic PC 2001 requirements**

**[13.49.] [REDUNDANT] Dynamic resource configuration is supported for all devices**

**[13.50.] [REDUNDANT] Each device complies with its device class power management reference specification**

**[13.51.] [REDUNDANT] Device supports wake-up events**

## Device Drivers and Installation for ~~I/O Ports and~~Input Devices

**[13.52.] [REDUNDANT] Device drivers and installation meet PC 2001 requirements**

**Note to Reviewers: This is a basic PC 2001 requirement**

**[13.53] All PC 2001 input devices support Microsoft DirectInput and work simultaneously**

All input devices implemented in a PC 2001 system must have drivers that support Microsoft DirectInput if they do not use drivers that are built into the operating system. ~~Also, All~~ input devices must be able to correctly provide simultaneous input. ~~Thus, is means that~~ no input device is disabled automatically when another input device is in use.

**Note:** The built-in drivers provided with Windows 98 and Windows 2000 meet this requirement.

For information about implementing drivers that support simultaneous use of devices, see the Microsoft DirectInput DDK provided with the Windows 98 DDK (online at [http://www.microsoft.com/ddk/ddkdocs/win98ddk/di\\_ddk\\_9rxw.htm](http://www.microsoft.com/ddk/ddkdocs/win98ddk/di_ddk_9rxw.htm)).

## Checklist for Input Devices

- [NEW] All non-integrated input devices meet USB HID specifications*
- [13.7] Devices use USB or external bus connections rather than legacy serial or parallel ports*
- [13.8] [REDUNDANT] All devices meet PC 2001 general device requirements*
- [13.9] Serial port meets device class specifications for its bus*
- [13.10] If implemented, legacy serial port is implemented as 16550A UART or equivalent and supports 115.2K baud*
- [13.11] If implemented, legacy serial port supports dynamic resource configuration*
- [13.12] If implemented, conflict resolution for legacy serial port ensures availability of at least one serial port*
- [13.13] Parallel port meets device class specifications for its bus*
- [13.14] If a legacy parallel port is implemented, flexible resource configuration is supported for each parallel port*
- [13.15] If a legacy parallel port is implemented, EPP support does not use restricted I/O addresses*
- [13.16] If a legacy parallel port is implemented, compatibility, nibble mode, and ECP protocols meet IEEE 1284-1994 specifications*
- [13.17] If a legacy parallel port is implemented, port connectors meet IEEE 1284-I specifications, minimum*
- [13.18] If a legacy parallel port is implemented, IEEE 1284 peripherals have Plug and Play device IDs*
- [13.20] If implemented, daisy-chained parallel port device is Plug and Play capable*
- [13.21] Pointing-device connection meets requirements for its bus class*
- [13.23] Keyboard connection meets requirements for its bus class*
- [13.24] No interference occurs between multiple keyboards*
- [13.25] If implemented, Windows and Application logo keys meet Microsoft guidelines*
- 13.26. [REDUNDANT] Game-control device meets USB HID class specification requirements*
- [13.27] IR device uses NDIS 5.0 miniport driver*
- [13.28] IR device meets IrDA specifications*
- [13.29] [REDUNDANT] IR device meets PC 2001 bus and port specifications*
- [13.30.] [REDUNDANT] IR device supports dynamic resource configuration*
- [13.31.] [REDUNDANT] IR device meets USB guidelines for interfacing with IrDA Data and IrDA Control devices*
- [13.32] System supports standard input speeds of 4 Mb/s*
- [13.33] System provides a separate, physically-isolated transceiver for each IR protocol supported*
- [13.38] Smart card reader complies with ISO 7816*
- [13.39] Smart card reader supports ISO 7816 T=0 and T=1 protocols*
- [13.40] Smart card reader supports inverse-convention smart cards*
- [13.41] Smart card reader supports 258-byte packets in T=0 and 259-byte packets in T=1*
- [13.42] Smart card reader supports a smart card insertion/removal monitor*
- [13.43] Smart card reader supports PTS*
- [13.44] Smart card reader supports 3.5795 MHz minimum clock frequency*
- [13.45] Smart card reader supports 9600 bps minimum data rate*
- [13.46] Smart card reader supports the Power Down command*
- [13.48.] [REDUNDANT] Each device has a unique Plug and Play device ID*

*[13.49.] [REDUNDANT] Dynamic resource configuration is supported for all devices*

*[13.50.] [REDUNDANT] Each device complies with its device class power management reference specification*

*[13.51.] [REDUNDANT] Device supports wake-up events*

*[13.52.] [REDUNDANT] Device drivers and installation meet PC 2001 requirements*

*[13.53] All PC 2001 input devices support Microsoft DirectInput and work simultaneously*